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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/055,157	10/22/2001	Bih-Tiao Lin	JCLA4827-CIP	8975

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 03/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/055,157	LIN ET AL.	
	Examiner	Art Unit	
	Anh D. Mai	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 January 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 10 January 2003 is: a) ☐ approved b) ☒ disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Amendment

1. Amendment filed January 10, 2003 has been entered as Paper No. 8. Claims 1, 8, 14 and 20 have been amended. Claims 1-20 are pending.

Drawings

2. The substitute drawings were received on January 10, 2003. These drawings are not acceptable.

The original drawing shows the thin film 150 is discontinuous and none was formed on the sidewalls 145, while the substituted drawing shows a continuous thin film 150 including on the sidewalls 145.

The disclosure state: "As shown in Fig. 1B, while a sputtering step is applied instead of chemical vapor deposition, almost no thin film 150 can be formed on the sidewalls 145".

New matters have been added in the specification.

Response to Amendment

3. The amendment filed January 10, 2003 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "substantially vertical sidewalls" and "removing the insulation layer above the active areas to expose the mask layer, while the screen layer and the thin film above the trench protect the insulation layer in the trench".

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “substantially vertical sidewalls” and “removing the insulation layer above the active areas to expose the mask layer, while the screen layer and the thin film above the trench protect the insulation layer in the trench” in the application as filed.

With respect to “substantially vertical sidewalls”, the original specification disclosing an insulating layer 140 being formed by HDP-CVD that results in a vertical sidewalls.

However, as amended, the vertical sidewalls is no longer existed.

The amendment appears to be a deliberate alteration of the disclosure rather than to correct a typographical error. Therefore, the amended matter is new matter.

With respect to “removing the insulation layer above the active areas to expose the mask layer, while the screen layer and the thin film above the trench protect the insulation layer in the trench”, the disclosure state: “In Fig. 1E, the insulation layer 140 on the mask layer 120 and the screen layer 160 above trenches 130 are respectively removed to expose the mask layer 120 and the thin film 150 remained on the trenches 130. If the insulation layer 140 is made of

Art Unit: 2814

silicon oxide and the screen layer 160 is made of SOG, since both the materials are silicon oxide, both can be removed in one step". (page 7, lines 2-6).

Therefore, the only layer that is capable of protecting the insulation layer in the trench is the *thin film* formed above the trench.

Further, the specification as amended, could not show how the thin film formed on the sidewalls of the insulation layer being thinner than anywhere else since the vertical sidewall is no longer existed.

As best understood by the examiner, the thin film has a same thickness since there is no vertical sidewalls existed.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1-3, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walsh et al. (U.S. Patent No. 6,228,741) (cited previously).

With respect to claim 1, as best understood by the examiner, Walsh teaches a method for forming a shallow trench isolation structure substantially as claimed including:

providing a substrate (10) comprising at least a trench (25) and an active region covered by a mask layer (20) and isolated by the trench (25);

Art Unit: 2814

forming an insulation layer (40) to fill the trenches (25) and to cover the mask layer (20) by HDP-CVD, wherein a surface of the insulation layer (40) formed over the trench (25) is higher than a surface of the substrate (10) and lower than a surface of the mask layer (20);

forming a thin film (50) on the insulation layer (40);

forming a screen layer (60) on the thin film (50) by a fluid precursor;

removing the screen layer (60) and the thin film (50) over the active region, while the screen layer (60) and the thin film (50) above the trenches are not removed;

removing the insulation layer (40) above the active regions to expose the mask layer (20), while the thin film (50) above the trench (25) protect the insulation layer (40) in the trench;

removing the screen layer (60) to expose the thin film (50) above the trench (25);

removing the thin film (50) above the trench (25) to expose the insulation layer (40); and

removing the mask layer (20) above the active region. (See Figs. 1-9).

Thus, Walsh is shown to teach all the features of the claim with the exception of explicitly disclosing removing the insulation layer (40) while both screen layer (60) and thin film (50) protecting the insulation layer in the trench.

However, since only the thin film (50) is needed to protect the insulation layer (40) in the trench and oxide is also contemplated by Walsh for the screen layer.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to remove the screen layer (60) along with the removal of the insulation layer (40) since the material for both layers is oxide and removing the screen layer (60) before, during or

Art Unit: 2814

after the removal of the insulation layer (40) on the active region does not depart from the scope of Walsh' invention.

With respect to claim 2, the insulation layer (40) of Walsh includes a silicon oxide.

With respect to claim 3, the thin film (50) of Walsh includes a silicon nitride.

With respect to claims 5 and 6, the screen layer (60) of Walsh includes a spin-on-glass or a photoresist.

6. Claims 8-10, 12-16 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walsh '741 in view of Kuehne (U.S. Patent No. 6,149,975) (cited previously).

With respect to claim 8, as best understood by the examiner, Walsh teaches a method for forming a shallow trench isolation structure substantially as claimed including:

providing a substrate (10) comprising a plurality of trenches (25) and plurality of active areas, wherein the active areas are covered by a mask layer (20);

forming an insulation layer (30) in the trenches (25) and on the mask layer (20), wherein the insulation layer (40) in the trench (25) has a surface higher than the surface of the substrate (10) and lower than the surface of the mask layer (20), and wherein the insulation layer (40) on the mask layer (20) has sidewalls;

forming a thin film (50) on the insulation layer (40) above the active areas and the trenches (25), wherein the thin film (50) is conformally formed on the insulation film (40);

Art Unit: 2814

forming a screen layer (60) on the thin film (50) by a fluid precursor, wherein the thickness of the screen layer formed above the active areas is thinner than the thickness of the screen layer formed above the trenches (25);

removing the screen layer (60) and the thin film (50) above the active areas, while the screen layer (60) and the thin film (50) above the trenches (25) are not removed;

removing the insulation layer (40) above the active areas, while the thin film (50) above the trenches (25) protect the insulation layer (40) in the trenches;

removing the screen layer (60) above the trenches (25);

removing the thin film (50) above the trenches (25); and

removing the mask layer (20) above the active areas. (See Figs. 1-9).

Thus, Walsh is shown to teach all the features of the claim with the exception of a) additionally covering the active region by a pad oxide and b) removing the insulation layer (40) while both screen layer (60) and thin film (50) protecting the insulation layer in the trench.

However, Kuehne teaches in addition to a mask layer (23), the active areas are covered by a pad oxide 22. (See Fig. 4).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to cover the active areas of Walsh with a pad oxide, in addition to the mask (20), as taught by Kuehne to relieve the semiconductor substrate at the active areas from stress caused by the nitride mask layer (20). This matter is well known in the art.

Art Unit: 2814

With respect to removing the insulation layer (40) while both screen layer (60) and thin film (50) protecting the insulation layer in the trench, the similar reason as that of claim 1 is also applied here.

With respect to claim 9, the insulation layer (40) of Walsh includes a silicon oxide.

With respect to claim 10, the thin film (50) of Walsh includes a silicon nitride.

With respect to claims 12 and 13, the screen layer (60) of Walsh includes a photoresist and a spin-on-glass.

With respect to claim 14, Walsh teaches a method for forming a shallow trench isolation structure, applicable to a substrate having at least an active area on the substrate (10), at least a trench (25) surrounding the active area and a mask layer (20) formed on the substrate (10) in the active areas, substantially as claimed including:

forming an insulation layer (40) in the trenches (25) and on the mask layer (20), wherein the insulation layer (40) in the trench has a thickness less than the sum of the depth (25) plus the thickness of the mask layer (20);

forming a thin film (50) on the insulation layer (40);

forming a screen layer (60) on the thin film (50) above the trenches (25);

removing the screen layer (60) and the thin film (50) above the mask layer (20) and above the active area, while the screen layer (60) and the thin layer (50) above the trenches (25) are not removed;

removing the insulation layer (40) above the mask layer (20) and the active area, while the thin film (50) above the trench protect the insulation layer (40) in the trench (25);

removing the screen layer (60) above the trenches;

removing the thin film (50) above the trenches; and

removing the mask layer (20) above the active areas. (See Figs. 1-9);

With respect to the addition of a pad oxide and removing the insulation layer (40) while both screen layer (60) and thin film (50) protecting the insulation layer in the trench, the similar reason as that of claim 8 is also applied here.

Note that, the insulation layer in the trench of Walsh has a thickness within the claimed range, lower than the top surface of the thin film (50) and higher than the substrate (10).

With respect to claim 15, the insulation layer (40) of Walsh includes a silicon oxide.

With respect to claim 16, the thin film (50) of Walsh includes a silicon nitride.

With respect to claims 18 and 19, the screen layer (60) of Walsh includes a photoresist and a spin-on-glass layer.

With respect to claim 20, the insulation layer (40) of Walsh is formed with a sidewall by controlling an etch/deposition ratio of a HDP-CVD.

7. Claims 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walsh '741 as applied to claim 1 above, and further in view of Breiten et al. (U.S. Patent No. 4,836,885) (cited previously).

Art Unit: 2814

With respect to claim 4, Walsh teaches forming a thin film (50) on the insulation layer (40).

Thus, Walsh is shown to teach all the features of the claim with the exception of using an alternative material for the thin film (50).

However, Breiten teaches a variety of materials can be used for the thin film (25) including nitride or polysilicon.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the thin film (50) of Walsh using polysilicon as taught by Breiten because polysilicon also provides for a similar etch selectivity to the insulation layer (40) as that of nitride material (50). This matter is well known in the art.

With respect to claim 7, the method of Breiten further includes forming a pad oxide (13) layer on the substrate (11) under the mask layer (15).

8. Claims 11 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walsh '741 as applied to claims 8 and 14 above, and further in view of Breiten '885.

Walsh teaches forming a thin film (50) on the insulation layer (40).

Thus, Walsh is shown to teach all the features of the claim with the exception of using an alternative material for the thin film (50).

However, Breiten teaches a variety of materials can be used for the thin film (25) including nitride or polysilicon.

Art Unit: 2814

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form the thin film (50) of Walsh using polysilicon as taught by Breiten because polysilicon also provides for a similar etch selectivity to the insulation layer (40) as that of nitride material.

Response to Arguments

9. Applicant's arguments with respect to all claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Although the same references have been applied, however, the amendment to the specification and claims have altered the scope of the invention, therefore, the new rejections are based on new grounds.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

Art Unit: 2814

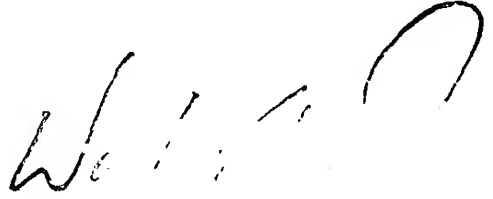
however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
March 12, 2003



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